February 12, 2002

Dr. Mimi Walker, Superintendent
Vashon Island School District
2014 Vashon Hwy SW
Vashon Island, WA 98070

Dear Dr. Walker:

Thank you for meeting with us last year to explain your concerns to us, and to seek guidance and greater understanding of ways to understand and reduce potential risk from arsenic and/or lead contamination in soils at or near your schools. This letter summarizes the information presented to you at that time. I apologize for the long delay in getting this information to you. Because yours is the first letter providing this information, it was necessary to extensively review the information to assure that we get accurate information to you. I have read accounts of your efforts in the Beachcomber, and appreciate your efforts on behalf of your students.

As we discussed during the meeting, we continue to recommend that you get an application in to the Solid Waste and Financial Assistance Program for future remedial actions. As you may recall, those funds are committed for this biennium. Your application would be considered in selecting grant recipients for the ’03-’05 biennium, and may be considered if funds become available late in this biennium.

General Characterization of the Tacoma Smelter Plume

The contaminated soils of the Tacoma Smelter Plume site are generally characterized by elevated levels of lead (Pb) and arsenic (As), with additional metals also present. Near the source, elevated cadmium (Cd) may also be of concern. The Tacoma Smelter Plume site is one of several large sites called area-wide sites, that include other smelter sites, orchard lands where lead arsenate was used, agricultural lands where ethylene dibromide was used as a soil fumigant, and other sites not yet fully identified or delineated. Ecology, the Department of Agriculture, Department of Health and Department of Community Development are currently convening a task force to provide better understanding of area-wide sites, and identify approaches to remediating this kind of site. Recommendations and guidance on sampling and remediation of area-wide sites is expected at the conclusion of the work of that task force. The probable source of much of the surface soil contamination is from the now-closed Asarco (American Smelting and Refining Co.) copper smelter that operated at Ruston near Tacoma. Arsenic occurs naturally in many kinds of rock, especially in ores that contain copper or lead. Contaminants from the smelter smokestack were spread by wind over a large area.

Because of the source, initial distribution of contamination was to the surface of the soil, and in undisturbed areas, most contamination remains in the upper 12 inches of the soil column. The highest concentrations are usually found at the 0-2 inch or 2-6 inch depth intervals (below soil surface). Throughout the Tacoma Smelter Plume site, contaminant concentrations vary over two orders of magnitude, often over very small areas. Thus samples collected from one area cannot be expected to be representative of soils in even nearby adjacent areas. (See **Findings from Soil Sampling of Vashon-Maury Island and the Southern Mainland Coastline of King County** (Public Health Seattle and King County, 2000) at the website:

http://www.metrokc.gov/health/hazard/soilsamples.htm#resident

At locations where soils have been disturbed, whether by logging, grading and construction, placement of fill, agricultural tilling or other causes, different contaminant depth distributions are found. In some cases at child-use areas, the highest concentrations were found at the 18-22 inch depth interval, with no assurance that the highest concentrations had been reached. Higher concentrations may be encountered at depths greater than those sampled.

This information is important because it highlights the need to thoroughly understand both the distribution of contaminants throughout the area to be remediated and the distribution depths of various levels of contamination. These two factors are critical to determining what remedial options are most appropriate to a particular property or decision unit (an area where remediation or testing is planned) within a property.

Remediation options are generally selected based on location-specific conditions, including future use of the land. The optimal remediation choices will vary based on those conditions. Cost factors may indicate amortization of cleanup costs over a long period of time, and result in a choice of a mix of temporary and longer-term remedial options to make best use of available funds to minimize risk throughout the time involved. Below are a number of remedial alternatives that are typically screened for consideration at sites with soil contamination.

Options for Remedial Action

The Model Toxics Control Act (MTCA) is the state cleanup law. MTCA states a preference for remedial actions that are permanent to the maximum extent practicable. MTCA does allow for less permanent cleanups if the costs of permanent cleanup are disproportionate to the benefits realized over less permanent alternatives.

By state regulation, a final cleanup action for contaminated soils at schools and child care centers must provide for treatment, removal, or containment of soils that exceed soil cleanup levels. WAC 173-340-360(2)(d). MTCA also allows for interim actions at any time to reduce risk of exposure or toxicity from contaminants until a final cleanup can be achieved.

Temporary (Interim Action) Options

The range of temporary remedial actions begins at simply excluding access to a contaminated area by some physical barrier, such as a fence. This reduces risk by precluding physical exposure to the contaminants.

Temporary capping or covering is another option, similar in that it reduces potential for people to come in contact with the contaminants. Materials such as gravel, bark chips, or rubber mats may be placed over the contaminated soil. Choice of this option requires behavior modification to prevent digging, which could expose contaminated soils. More durable coverings such as asphalt or concrete can also be used for temporary capping.

Raised Beds

In small areas used for plant cultivation or growing food plants, installation of raised beds using clean soils (often separated from underlying contaminated soils by a porous root barrier) is an option. This use of clean soil (certified by chemical analysis for metals of concern) removes the potential for contact with contaminated soils by gardeners, and contact of plants with metals contamination. Because of its arsenic content, use of CCA (Chromated Copper Arsenate) treated wood for raised bed construction is specifically recommended against.

Longer-term (Final Cleanup) Options

The below options are described in conceptual terms only. Each option requires location-specific analysis to determine whether it will achieve final cleanup standards.

Stabilization

With stabilization, contaminated soils are excavated and mixed with stabilizing agents that bind with the contaminants to reduce the toxicity and/or mobility of the contaminants. The stabilized soil is then put back in place. The long-term performance of the stabilizing agent is uncertain. Many stabilizing agents either become unstable, or are depleted over time. Hence long-term monitoring to ensure the contaminants stay bound up would be necessary.

Tilling

Because of the large areas affected by the Tacoma Smelter Plume, Ecology is considering dilution of contaminated soils with clean soils to achieve the final cleanup standard of 20 parts per million (ppm) arsenic. This method is more difficult than it might at first seem due to the volumes of clean soils required, and the technical difficulty of achieving complete mixing of clean and contaminated soils. Although more trials are needed, it seems likely that this option will only be viable where the maximum concentration of arsenic is 40-50 ppm or less, contamination is confined to the upper 12 inches of soil, and aggressive mixing methods are used. It will be necessary to perform some confirmational sampling to ensure that the cleanup levels have been attained.

Excavation and Disposal
"Dig-and-haul," wherein the contaminated soil is excavated, hauled to an approved disposal location (as approved by the local Health authority and/or Ecology based on waste characteristics) and replaced with clean soil. This option assumes a location that can accept the volumes of waste soil generated. Dig-and-haul is cost-effective , and requires no further monitoring once completed. At wide-area sites like the Tacoma Smelter Plume, the volume of soils site-wide makes this a less attractive option, even though it may be otherwise a good choice on a property-specific basis.

Containment
Containment means that contaminated soil is excavated, and placed back on site in a completely enclosed location, isolating contaminants from the environment. Containment can be within a building foundation (with a concrete or geotextile bottom), and eventual coverage with a slab or other impermeable cover. Such containment facilities have been used for basketball and tennis courts, building bases and parking lots. Because the contaminated soil is still on site, long-term monitoring to ensure that the material remains contained will be necessary

Capping
Capping means covering the contaminated area either with an impermeable or low permeability material such as geotextile, clay or pavement, or with at least 1 foot of clean soil. Ecology does not support placement of soil caps of less than 1 foot of clean soil, and recommends placement of a heavy, permeable geotextile barrier between a clean soil cap and contaminated soil to mark the different layers. In some cases where contaminant levels are very high, one foot of soil may not be adequate. With capping, no side or bottom containment is used, and contaminants subject to groundwater exposure may migrate away from capped areas. Long- term monitoring is necessary to ensure the integrity of the cap and adequate protection of groundwater.

Phytoremediation
Phyto-remediation is the use of plants as a concentrator of contaminant metals, to remove the contaminants from the soil and either displace to air (volatile organic compounds) or incorporate into plant tissue (metals) those contaminants. Plant tissues after "harvesting" will need to be characterized for disposal, as the plant tissues are now contaminated. If non-native plants are used, their potential to become invasive must be considered, as well as the potential for ingestion and harm to children and animals. The Chinese Brake Fern (*Pteris vitatae*) has the highest known arsenic bioconcentration factor for arsenic, and is licensed for remediation use by a private sector firm in Virginia. Other plants may have some potential for bioconcentration of lead and/or arsenic. Because of the differing mobility characteristics of arsenic and lead, and different plants suitable for bioremediation of the two metals, sequential remediation of arsenic and lead (using different plants and/or soil amendments) may be a viable consideration.

I hope this information is helpful to you in choosing how to address lead and arsenic contamination at your schools. If you have questions, feel free to contact me at (425) 649-7047, or by email at nope461@ecy.wa.gov. If you would like to enter the Voluntary Cleanup Program to obtain guidance and review for specific remediation projects, I can provide you with application forms and additional information about Ecology's Voluntary Cleanup Program on request. Thank you so much for your dedication and efforts to protect the health of your children, and all the students in your school district.

Sincerely,

Norman D. Peck
TSP Site Manager
Department of Ecology
Toxics Cleanup Program
Northwest Regional Office

NP:jc

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